BAY AREA AIR QUALITY MANAGEMENT DISTRICT

BAAQMD Methane Measuring Initiatives

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Current LDAR Programs

- Air District oversees several LDAR programs for fugitive organic gases
  - for each refinery, bulk terminals and chem. plants
- Concentration-based leak thresholds enforced
  - Equipment: Toxic Vapor Analyzer (FID system)
  - Methodology: EPA Method 21

- Leaks > 10,000 ppm
  - 45 days to either measure mass emissions rate or to decrease leak under threshold
  - Obtaining mass leak rate is time- and effort-intensive
    - Procedure: “bag” the leaking component, measure the flowrate and take samples to be processed in the lab
- EPA-estimated emissions reduction w/ LDAR: 70-80%

CH_4 Measuring Initiatives

- Goals
  1) To improve the Air District's GHG emissions inventory and track long term pattern of CH_4 emissions
  2) To trace, identify and quantify methane emissions from individual sources within the Air District
- Measurements
  - ~4 Fixed Monitoring Sites (Goal 1)
    - At exit flow points from Bay Area (well-mixed plumes, downwind of multiple CH_4 sources)
    - Co-located with existing BAAQMD monitoring sites to benefit from existing data collection (e.g., met, organic gases, NO_x and CO)
  - Mobile Lab (Goal 2)
    - To identify and quantify individual sources, and to perform source attribution
    - To be equipped with high-precision CH_4 concentration measuring equipment

Measuring CH_4 with Mobile Lab

- Main technologies under consideration
  - Picarro/LGR Trace Gas Analyzers
    - Pros: Lower cost; service/repair in Bay Area; can measure CH_4 isotopes
    - Cons: CH_4 isotopes not easily interpretable
  - Portable LGR
    - Pros: Can take measurements on-site; get closer to source
    - Cons: Similar cost to trace analyzers w/ lower precision
  - Aerodyne Dual QC Laser Trace Gas Monitor
    - Pros: Highest precision; can measure ethane, an indicator of non-biogenic CH_4
    - Cons: Highest cost; bulk of equipment may be drawback for mobile application

Other Initiatives

- EDF/Google Outreach Partnership
  - Google Street View cars measure CH_4 concentration (Picarro), wind speed/direction, and location
  - Methane leak maps of various cities in NY, IN, MA, VT and soon CA (Los Angeles)
  - More info: http://www.edf.org/climate/methanemaps
- Bottom-up measurements
  - Lamb et al., 2015: High flow sampler + Tent over "sniffed leaks"
- Top-down measurements
  - Satellites: Kort et al., 2014; Miller et al., 2013 (US)
  - Airplane: CALGEM project led by Dr. Fischer
  - Fixed monitoring sites:
    - Fairley and Fischer, 2015 (SF Bay Area)

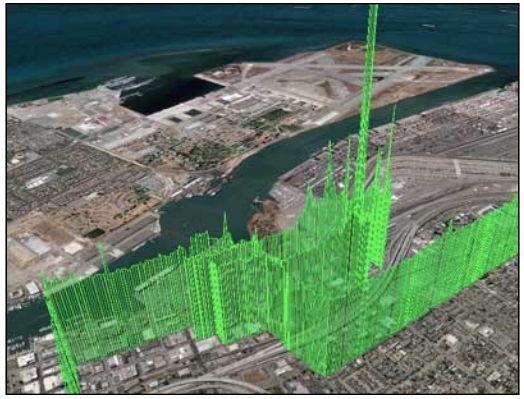

Image: http://calgem.lbl.gov/measured_data.html

Any questions?

Thank you for your attention!

Methane Detection Technology

Parameter	Open-path	Closed-path
Instrument examples	LI-COR 7700 CH_4 analyzer	Picarro, LGR
Principle	air moves freely though measuring path of gas analyzer	air is forced into measuring path by pump
Energy consumption	Lower (~10 W), can be operated with solar panels	Higher, due to pump (~40 W)
Data loss due to precipitation	Minor	Minimal
Data speed	Up to 40 Hz	<5-10 Hz (slow); >5-10 Hz (fast)
Precision	High, but require frequent calibration	Instrument dependent; can be High
Advantages	Excellent stability; suitable for harsh environments; portability	Can employ various sensing technologies (e.g., NDIR, laser absorption, GCs)
Disadvantages	Density correction (i.e., WPL) due to changes in T, moisture	Tube attenuation (minimal for CO_2, CH_4; affects H_2O)